

Standard Work Category 200. Information regarding the Standard Work Categories can be found on NDOR's website.

1. Basic Scope

The consultant shall acquire four-band color DMC II digital aerial photography (Blue, Green, Red, Near-Infrared) of requested project areas. Large-format, frame-based photogrammetric digital aerial mapping systems equivalent to the DMC II that have the same near-square image footprint, and are compatible with Intergraph's aero triangulation (ISAT), mapping (ISSD), and ortho photo production (ISOP) software will also be considered. References throughout this document to the DMC II shall apply to any alternate sensor used. This photography will be used by NDOR for stereo compilation and orthophoto production.

2. Aircraft and Crew

The consultant shall be responsible for operating and maintaining all aircraft used in conformance with all governing Federal Aviation Administration and Civil Aeronautics Board regulations over such aircraft. Preference may be given to consultants who own the aircraft and DMC II system used. All flight crew members must have two years or more experience flying precise photographic missions for aerial surveys. The consultant shall be responsible for applying for and obtaining any required permits for access, overflight, or intrusion into restricted or otherwise limited ground access and/or airspace which may be included within a project's scope of services

3. Acquisition Delays

The consultant shall inspect and constantly monitor the photographic coverage and quality, and shall undertake immediate reflights of areas wherein coverage does not meet specifications. Rejection of photography by the consultant or NDOR shall not in itself be a reason for granting a delay.

4. Environmental Conditions during Photography Acquisition

Aerial photography will be collected in accordance with American Society for Photogrammetry and Remote Sensing (ASPRS) Standards for Aerial Photography whereby the image acquisition shall not be secured when the ground is obscured by haze, fog, snow, smoke, dust, flood waters, or environmental factors that may obscure ground detail. There should also not be any digital artifacts that adversely affect the proper tone value of pixels as a result of digital image post-processing. The following weather conditions are a minimum which shall be met or exceeded during photo missions:

- a. Sun angle. Photography shall be taken when the sun angle is 30 degrees or greater above the horizon. There shall be no objectionable shadows created by relief or low solar altitude.
- b. Cloud cover. Images shall be free of clouds and cloud shadows. No photography will be accepted with clouds or cloud shadows appearing on more than 5 percent of the area in any one image file.
- c. Season. With the exception of wetland project areas, photography shall be acquired mostly during the leaf-free season in the spring and fall, and deciduous trees must be barren. Acquisition of color photography shall not begin until after March 24th, or in the event of an early spring, until the grass has turned green.
- d. Turbulence. Photography will not be taken during adverse conditions when wind and thermal currents are causing excess tilt, crab, or drift in the photography.
- e. Ground conditions. Avoiding conditions that might obscure ground detail shall be the responsibility of the consultant.

5. Intergraph DMC II Specifications and Certification Reports

The consultant must possess a U.S. Geological Survey (USGS) Data Providers certification or equivalent. Each DMC II used shall:

- a. Be compatible with precision stereoscopic mapping instruments and with mensuration procedures used in photogrammetric surveys and in preparing accurate orthoimagery.
- b. Have enough high resolution and have a large enough field of view to provide the required ground sample distance and stereo coverage of desired ground swaths defined by project boundaries.
- c. Must capture a minimum of 8 bits per color channel.
- d. Have a manufacturer's type certification from the USGS or equivalent.
- e. Be calibrated, geometrically stable, and capable of meeting minimum specified criteria for photogrammetric mapping in accordance with ASPRS guidelines.
- f. Have a report detailing its calibration. Any incomplete reports shall be cause for rejection of the data. Calibration reports for each DMC II used should be supplied to NDOR.

6. Photographic Coverage

The consultant shall prepare flight plans and determine acquisition flight height and GSD based on DMC II sensor technology balanced against a project's expectations and specifications for acquiring photography (NDOR's aerial surveys must have a 90% vertical accuracy confidence of 0.4 feet or better). All flight lines must extend at least two frames beyond the required coverage boundary. The photographic survey areas of the project shall be stereoscopically covered by successive and adjacent overlaps of photographs within the usable portion of the field of the sensor. Lack of acceptable stereoscopic coverage shall be corrected by re-flights at the consultant's own expense. Except on short flight lines, a minimum of two runoff or blank frames is required between usable frames immediately prior to the start of the photography for each flight line or part of a flight line (individual flight lines may be stored in individual folders). Forward overlap in the line of flight shall average not less than 57% or more than 62% at mean elevation of the terrain unless otherwise specified. Individual overlaps shall not be less than 55% or more than 68%, excepting the situation where in a forward overlap in areas of low elevation must exceed 68% to attain the minimum 55% forward overlap in adjacent areas of higher elevation. The following specifications also apply:

- a. Junction areas between adjoining flight lines shall be covered stereoscopically by both lines (wherever there is a change in direction between two flight lines).
- b. Side overlap between adjacent parallel flight lines shall be 30% +/- 10% at the mean elevation of the terrain.
- c. Flight line deviation shall not exceed a distance greater than 10% of the width of the coverage of the photograph.
- d. Departures from flight height required shall not exceed -2% or +5% unless changed by Air Traffic Control Centers.
- e. Changes in the course of the aircraft between successive overlapping photographs within a flight line shall not exceed 3 degrees.
- f. While collecting aerial photography, the DMC II shall be compensated for crab of the aircraft, with a resultant error not exceeding 3 degrees.
- g. The tilt within a single frame shall not exceed 4 degrees nor shall the difference in tilt between two consecutive overlapping frames within a flight line exceed 4 degrees. The average tilt for all frames of the same nominal scale shall not exceed 1 degree.
- h. The combined effect of aircraft course corrections, crab, and tilt shall result in an apparent crab not greater than 5 degrees on successive frames. Apparent crab is defined as the angle between the indicated principal point and the conjugate image of the indicated principal point of the adjacent photograph within the same flight line.
- i. The photo missions shall be executed within the shortest possible timeframe

- to insure consistent ground and lighting conditions.
- j. All photos within a single project shall be acquired with the same DMC II.
- k. The images shall be clear and sharp in detail, and of uniform tone and degree of contrast to permit ground details to show clearly in all scene reflectance, with particular emphasis on pattern recognition in the shadow areas.
- l. The digital imagery must conform to accuracy and quality standards established by the ASPRS.

7. Reflights

Unacceptable aerial photography shall be re-flown at the earliest opportunity, weather permitting, by the consultant at no additional cost to NDOR, with the reflight coverage overlapping the accepted photography by at least two stereo models.

8. Control Points

Control point targets will be placed by NDOR survey crews. Targets will be in the form of circular shaped painted targets (36" diameter) and square shaped cloth targets (42" wide). The consultant shall give NDOR advance notice prior to beginning the aerial flights.

9. Project Reports and Metadata

Written progress reports must be submitted monthly. A final report on the production process and quality control information generated throughout the project will be provided at the end of the project. The consultant shall provide metadata compiled to the current standard endorsed by the Federal Geographic Data Committee for each of the data deliverables.

10. Deliverables

Digital imagery acquired for NDOR projects will be the explicit property of NDOR. The consultant is expressly prohibited from retaining, using, selling, or distributing in any manner any such materials and data without the expressed written consent of NDOR. At conclusion of a project, the consultant shall deliver the following data to NDOR unless otherwise instructed:

- a. Digital metadata files compiled to the current standard endorsed by the Federal Geographic Data Committee for each of the data deliverables.
- b. Imagery/Digital Image Inspection and Flight Log Report. All reports shall be delivered in digital form as Adobe Acrobat (.pdf) documents.
- c. Digital Flight/photo index files. Digital flight line index must be included with the image files that indicate both photography center points and flight line directions. This may be provided via a kml/kmz file generated from the flight data. Additionally, date and time of image capture shall be included as a metadata field.
- d. Digital camera image exterior orientation parameters will be provided in an electronic ISPM file format that is ready for use with Intergraph ImageStation Automatic Triangulation software
- e. Compressed color [RGB] and infrared [CIR] digital image files (ZI Compression, Q=5) that are usable with Intergraph photogrammetric software. These files will be in TIFF file format and stored on external hard drive(s).
- f. DMC II manufacturer's calibration certificate/report. Calibration reports for each DMC II used should be supplied to NDOR

11. Delivery Schedule

The consultant shall include an estimated delivery schedule. The consultant assumes responsibility for loss of, or damage to deliverables in shipment until delivery is confirmed in writing. NDOR will review the deliverables received in a timely manner for

compliance with specifications. The consultant must agree to promptly correct all defects and/or failures to comply with specifications contained herein for which the consultant is responsible.